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Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554

In the Matter of )  
 )  
Advanced Television Systems and Their ) MM Docket No. 87-268  
Impact Upon the Existing Television )  
Broadcast Service )

To: The Commission

**COMMENTS OF APPLE COMPUTER, INC.**

Apple Computer, Inc. ("Apple") hereby comments on the Fourth Further Notice of Proposed Rulemaking and Third Notice of Inquiry (the "Notice") in the above-captioned proceeding.

**I. THE PROMISE OF ADVANCED TELEVISION — PURPOSE OF THIS INQUIRY**

Eight years ago the Commission initiated this proceeding to promote the development of "High Definition Television" ("HDTV"), a new technology designed to improve the visual and aural clarity of broadcast transmissions. Since that time, advances in technology — most particularly in the digital domain — have made possible a more dramatic revolution in television. While HDTV would have made it possible to deliver higher quality pictures and better sound, but little more, Advanced Television ("ATV") will enable broadcasters to deliver a wide range of video, audio, graphics, text, and data to households across the country.<sup>1</sup> Properly implemented, ATV will make it possible to transform traditional television into a new education and entertainment medium, integrate broadcasting into the National Information Infrastructure ("NII"), and provide an additional path to connect households across America to the NII and the NII to the world.

The purpose of the Notice is to review certain policy decisions regarding the implementation of HDTV and ATV in light of the new vision

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<sup>1</sup> Notice at ¶ 4.

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of ATV, in order "to ensure that the introduction of digital television fully serves the public interest."<sup>2</sup> In the Notice, the Commission requests comment on a range of issues, including how to promote spectrum efficiency, how to manage the transition to ATV and the recapture of "old" broadcast spectrum, the extent to which broadcasters should be permitted to use their ATV spectrum for new services, and how to define and enforce public interest standards in the "new" broadcast marketplace.

On the surface, these issues do not appear dependent upon the technical issues involved in defining the ATV standard. In reality, however, the adequacy of the ATV standard and, in particular, whether this standard will promote or hinder television and computing compatibility, will have a profound effect on many of the issues addressed in the Notice.

Apple has a strong desire to see that the promise of ATV is fulfilled. It is responding to this Notice because it has concluded that aspects of the ATV framework that is to be proposed to the Commission will limit the extent to which ATV achieves its objectives.

## **II. UNDERLYING PREMISES**

An important premise underlying this Notice is the belief that the migration to ATV will promote television and computer compatibility, which will make possible a range of new entertainment, information, and education services. For example, the Notice states that "[m]any aspects of the Grand Alliance system promote compatibility with computer applications and thus enhance its ability to support the National Information Infrastructure," that the Grand Alliance system, "has earned widespread support from [the computer] industry," and that this compatibility is "an important feature in guiding our deliberations."<sup>3</sup>

Apple agrees that the migration to ATV can promote the integration of televisions and computers and the delivery of new services. However, it is

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<sup>2</sup> Notice at ¶ 1.

<sup>3</sup> Notice at ¶ 18.

Apple's considered opinion that the Grand Alliance system contains elements that will obstruct rather than facilitate this integration.

ATV's potential to marry the strengths of the television industry with those of the computer industry is directly linked to many of the policy issues that are specifically addressed by the Notice. For example, the pace of migration of consumers to ATV — and the prospect of recovering promptly 6 MHz of spectrum — depends on the affordability and value offered by ATV "sets." If the ATV standard impedes the marriage between broadcasting and computing — for example, by making integrated television/computers very costly — it will retard the transition to ATV and, thereby, delay spectrum recovery.

Similarly, if the ATV standard unnecessarily increases the cost of "smart" televisions, it will deny the benefits of new ATV services to those in low income schools and households. Some families will continue to use their existing televisions or separate computer, and will not benefit from new ATV services. Many may purchase the lowest cost receivers, and will be angered by the need to upgrade again if they are unable to receive and display the non-interlace scanned images, text, and graphics that will allow their system to function as a true information appliance, rather than an entertainment display. Others will be able to afford a single "smart" television, and will have access to new services in the family room but not at their children's desk or in the parent's room. In short, an inadequate ATV standard will at best result in additional costs, consumer frustration and delays in migrating to ATV, and at worst will further stratify our society between information "haves" and "have nots."

For this reason, the adequacy of the ATV standard cannot be separated from the questions raised in the Notice. If policy decisions are predicated upon flawed assumptions, the policy decisions themselves will suffer. Moreover, the basic question of whether the ATV standard will promote an integration of television and computing is important and should not be relegated to a quasi-technical, last-minute "review" of the proposal submitted by the Advisory Committee on Advanced Television Service ("ACATS"). In this proceeding, the Commission and industry have an opportunity to make forward-looking decisions that will allow the engineering and creative talents

of broadcast television companies and the research intensive and interactive capabilities of software and hardware companies to blend in new and exciting ways.<sup>4</sup> Unfortunately, they also could lock America into a standard that will thwart development and innovation and chill opportunities for learning and entertainment, perhaps for generations to come.<sup>5</sup> Consequently, even if one could separate "technical" issues from the "policy" matters specifically raised by the Notice and defer consideration of the former, such an approach would be profoundly misguided.

### III. APPLE HAS SEVERAL CONCERNS ABOUT THE CURRENT ATV STANDARD

For these reasons, Apple has chosen to respond to this Notice to express its serious concern that the current ACATS standard is flawed and must be corrected. The changes that are required are relatively few in number, but they are absolutely fundamental. In particular, Apple is concerned that elements of this system do not allow for optimal image fidelity and data delivery and are not cost efficient.

Apple is not a newcomer to this process. It has long believed that the integration of computing and television will be in the best interests of consumers world-wide, will be less costly, result in less obsolete equipment, help democratize the access to information, and will reduce impediments to the creation of appropriate software. In light of these views, Apple has been

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<sup>4</sup> In a recent speech Chairman Hundt delivered to the Information Technology Association of America, he cited an article from The Economist magazine that summarized the "new" vision of digital television:

"As the transmission of information is increasingly digitized, the boundaries between the telephone, the television, and the computer are blurring. Put the three together and all sorts of unpredictable new products and services start to evolve from the fun of television, the brain and memory of the computer, and the two-or-more-way human contact of the telephone."

Speech by Reed Hundt, Chairman, Federal Communications Commission, before the Industry Leadership Conference, Information Technology Association of America, Nashville, Tennessee, at 2 (as prepared for delivery) (Oct. 9, 1995).

<sup>5</sup> While this proceeding nominally focuses on the standards for broadcast television, the choice of standards will influence the way in which content is presented in all electronic media, including film, video, and CD ROM. Its effect, therefore, will be felt throughout the telecommunications and information industries. An analogy to bear in mind is the transition of audio entertainment delivery from records and tapes to CD's. While CD's initially served the primary function of transport of digitally recorded music, that technology evolved rapidly so that it now delivers data, video, interactive games and learning resources.

an active and forthright participant in the advanced television deliberations for the past seven years (although not as a formal member of ACATS), and has consistently advanced views intended to further the integration of these two complimentary technologies.

While Apple recognizes the efforts of the Grand Alliance and acknowledges that it has made some progress in addressing the computer industry's concerns, compromise and accommodation are not the proper test of success. Rather, the test must be whether the standards that are about to be recommended will permit — or, at a very minimum, not impede — the convergence of computing and entertainment technologies. On this ground, the ACATS proposals will not succeed.

Apple and other industry representatives will issue a statement in the next several weeks that will outline aspects of the current ACATS proposal that require revision. Briefly stated, however, Apple's core concerns are the following.

### **Image Fidelity**

Several factors affect the quality of displayed images and create potential problems for the integration of computing with broadcasting. Apple believes that eliminating interlace formats from the ATV standard will overcome the most important hurdle.

The ACATS standard proposes to permit broadcasters to choose among several transmission formats, including several which employ "interlace" scan displays. High quality text and graphics, however, cannot be read clearly on interlaced sets. This is why the computer industry has used non-interlaced (or "progressive scan") displays at relatively high refresh rates.

Indeed, Intel Corporation, along with a number of technical and media partners, recently proposed an "Infocast" scheme for transmitting data in the retrace interval of the conventional NTSC transmission. It is informative to note that the preferred way of receiving this information is the computer, not the television screen, primarily because the display capabilities of the television are not sufficient to display the material adequately. It is just this inadequacy that should not be perpetuated in the new ATV proposal.

Advanced television will make possible a variety of new services, many of which will require the mixing of computer-generated text and images with those of television. In some cases, the transmitting station will add the data stream or image for the text and graphics to the transmitted signal, while in other cases the information may come from other sources and be mixed together at the receiving end.

With progressive scan ATV and HDTV, text on television screens could be read almost as easily as is possible on today's computer screens. Because interlacing is not sufficient for data, however, including interlace formats in the ATV standard will stifle the development of educational, scientific, and other services that seek to incorporate both video images and computer-based information. Although the proposed standards include progressive scan formats, the inclusion of interlace, whenever it is used, will hamper the simultaneous use of computer generated text and graphics. Moreover, there is a potential for the interlace parts of the proposal to become the standard means of transmission because of the weight of existing interlaced technology that now exists as a result of the NTSC reliance on interlacing. It will not be possible to move to the modern age with enhanced, improved services if broadcasters and users are hobbled by old-fashioned, inadequate methods simply because of these methods' historical primacy.

Although it is possible to transform an interlaced signal into a progressive signal at the receiver, this is an expensive and imperfect solution. De-interlacing requires the tracking and finding of every object in every frame, which is not a trivial feat of engineering. As a result, the costs for computer-compatible televisions could be quite high,<sup>6</sup> limiting the number of individuals, schools and households having access to an integrated television/computing resource and restricting the applications for which they could be employed.

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<sup>6</sup> A de-interlacer would have to be included in all "computer-compatible" televisions, since neither the manufacturer nor the purchaser would know whether a given television would be used, either at the time of purchase or in the future, to receive interlaced-format broadcast signals.

To enable full integration of television with the display requirements of information, education, and commerce, it is of central importance that new formats employ only non-interlace standards in the transmission channel and at the display.

Several other issues — including transmission rate, over scan definition, aspect ratios, colorimetry, and non-square pixel spacing — also merit further consideration. Of these issues, the proposed transmission rate of 60 Hz is of particular concern. A 60 Hz display rate has not proven to be sufficient for the display of text and fine graphic information with the resolution expected by computer users. The computer industry tried 60 Hz rate in the late sixties and made a transition to 70 Hz for a very good reason: the lower rate was not adequate for prolonged viewing. Some provision for rates of presentation greater than 70 Hz is recommended. Apple will provide further, detailed comments on these issues in a future submission specifically addressing the ACATS proposal.

#### **Error-free data delivery**

It is important that the ATV system be capable of providing error-free data for the display of text, graphics, and other information services. Although the proposed formats allow for data transmission, they do not yet specify the required error correction mechanism or protocol. Without such specification, different systems might use different standards, which will lead to incompatibilities and make universal reception difficult or impossible. Many of the important, new usage scenarios made possible by rapid technology advances in personal computers require the delivery of packets of digital data to the (now smart) receiver. These packets of data carry programs to be executed and a wealth of information. The proposed standard decouples the mechanism for the digital transmission of information from the meaning of this information.

#### **CONCLUSION**

The emerging new services of the current technological revolution will result from a merger of the communication and display powers of television, the text and graphics power of the computer, and the world-wide

information services of the NII. The prospective benefits for education, home, government, and business are enormous.

Considerable scientific research on the human perceptual system demonstrates that current television display methods are insufficient to support this potential revolution in services. The hard-earned experience of the computer industry is consistent with scientific findings. Both scientific evidence and practical experience has caused the computer industry to use high resolution displays, with data elements spaced equally both in the vertical and horizontal directions ("square pixels"), a refresh rate greater than 70 times/second, and progressive rather than interlaced scanning. In addition, the high accuracy required for the transmission of textual and numerical data require specialized protocols for the transmission that greatly minimize errors, protocols that are standard in the data-transmission industry. Finally, the American Society of Cinematographers ("ASC") has noted that the 16/9 aspect ratio chosen for ATV does not correspond to any existing motion picture standards.

Unless these deficits of the proposed standards are remedied, the potential of the emerging industries will be stifled at birth. Television will fail to live up to its potential but will instead remain simply a vehicle for entertainment and traditional news, documentaries, and advertisements. The changes required are not major revisions: they are readily incorporated into the existing proposals. Indeed, in some cases they are a simplification of the proposals. In short, if the emerging potential is to be realized, Apple requests that the standards be modified so that:

- ATV does not employ interlaced transmission;
- the refresh rate allow rates greater than 70 images/second;
- improved standards of data integrity are incorporated; and
- the data elements be displayed at equal distances, both horizontally and vertically ("square pixels").

In addition, Apple supports the ASC in its request to reconsider the aspect ratio to a format more appropriate for the cinematic medium. We are at the beginning stages of a new era in education, business, communication,

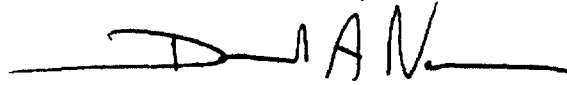


and entertainment. As we go forth with the ATV standards, it is essential that we make them work for this era and not be hamstrung by deficient standards made in the name of expediency. Standards are with us for a long time. The basic display parameters of the NTSC standards were developed in the 1950's and are still with us in the 1990s. The new ATV standards may very well last just as long. At the same time as standards persist unchanged, costs drop rapidly, especially for electronic and computer hardware and software. What seems expensive today will be inexpensive tomorrow. Wrong standards will hamper us for decades.

For these reasons, the Commission must take steps to assure that the ACATS standard is revised to remove the fundamental flaws that currently threaten to increase unnecessarily the cost and complexity of new television/computers, or to prevent the integration of these technologies altogether. This is an opportunity that cannot be missed.

Respectfully submitted,

APPLE COMPUTER, INC.

A handwritten signature in dark ink, appearing to read 'DAN', with a horizontal line extending to the left and right.

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